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IMPORTANCE AND CHARACTER OF THE MILLED RICE IMPORTED INTO THE UNITED STATES.

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INTRODUCTION.

In the United States the annual production of rice has not been sufficient to supply the domestic demands for this cereal; hence, it has been necessary to augment the American crop by importing large quantities from abroad. The competition on our markets between the home-grown rice and certain grades of foreign rice has become a matter of vital importance to the rice producing, milling, and handling interests in Louisiana, Texas, Arkansas, South Carolina, and California. For successful competition those connected with the rice industry of the United States should have a knowledge of the quantity, quality, and condition of the rice imported and be familiar with the most common rice types of foreign origin. To secure information concerning the economic value of the rice imported, to study its quality and condition at the time of importation, and to determine the characteristics of the most important types of foreign rice found on American markets, an investigation of the importation of rice into the United States was made in the spring and summer of 1914. It is expected that the information secured will not only be beneficial to those connected with the production, milling, and handling of the domestic crop, but will also be of interest to the importers, dealers, and wholesale grocers who now handle foreign rice, and to rice consumers in general. The quantities of rice brought in are found to vary yearly

and to depend upon the prices prevailing, the growing and harvesting conditions existing throughout the rice-producing countries of the world, and the tariff and other shipping conditions under which the importations are made.

QUANTITY AND VALUE OF RICE IMPORTED.

Through the courtesy of the Department of Commerce the detailed list of rice imports shown in Table I was secured. It will be seen on examining this table that the quantity and value of imported rice have become greater from year to year, and especially is the increase noticeable in the milled rice when the total for the fiscal year ended June 30, 1914, is compared with that of 1912 and 1913. Table I shows that practically $5,000,000 worth of rice was imported during the fiscal year ended June 30, 1914, an increase of about 60 per cent over the importation of 1913 and 100 per cent over that of 1912.

TABLE I.—*Quantity and value of rice imported into the United States during the fiscal years ended June 30, 1912, 1913, and 1914, according to the countries from which shipped.*

PART I.—UNCLEANED OR "BROWN" RICE (INCLUDING "PADDY" OR ROUGH RICE).

Exporting country.	1912		1913		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Europe:	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
France	833	7				
Germany					66,805	1,280
Italy	615	13			39,221	1,650
Netherlands					508,931	11,298
United Kingdom			56,000	1,307	120	9
North America:						
Canada	44,320	1,596	55,070	1,638	29,900	1,129
Mexico	285,384	9,911	963,738	33,934	411,897	18,016
West Indies			25	3		
South America:						
British Guiana					798,102	12,032
Asia:						
China	128,268	4,403				
Hongkong	20,220	503	3,185,195	74,920	576,525	17,415
Japan	47,998,624	1,601,946	47,519,298	1,788,279	52,013,918	1,845,349
British India					338,632	9,480
Total	48,478,264	1,618,379	51,779,326	1,900,081	54,784,051	1,917,658
Recapitulation:						
Europe	1,448	20	56,000	1,307	615,077	14,237
North America	329,704	11,507	1,018,833	35,575	441,797	19,145
South America					798,102	12,032
Asia	48,147,112	1,606,852	50,704,493	1,863,199	52,929,075	1,872,244

PART II.—COMPLETELY MILLED RICE.

Europe:						
Belgium			56,000	1,729	900	27
Denmark					220	10
France	6	1				
Germany	39,884	1,502	218,084	7,035	4,716,558	153,250
Greece	2,379	150	1,725	111		
Italy	1,817,925	65,308	1,239,353	47,186	1,421,615	54,072
Netherlands	2,401,257	88,128	2,521,070	98,440	48,407,957	1,632,584
Norway			200	20		
Spain	76,734	2,988	57,550	2,289	89,899	3,324
Switzerland					599	50
United Kingdom	4,586,094	118,119	3,631,443	107,436	4,871,248	136,844

TABLE I.—*Quantity and value of rice imported into the United States during the fiscal years ended June 30, 1912, 1913, and 1914, according to the countries from which shipped*—Continued.

PART II.—COMPLETELY MILLED RICE—Continued.

Exporting country.	1912		1913		1914	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
North America:	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
British Honduras			152	4		
Canada	13,734	656	7,337	526	411,413	12,268
Mexico	18,710	950	3,395	215	6,158	452
West Indies	1,472	64	18,379	526	2,522	114
South America:						
British Guiana					542	15
Asia:						
China	13,047,902	466,469	21,560,121	820,009	30,417,603	864,736
Chosen (Korea)					42,294	1,306
British India	393,708	10,844	528,147	16,436	531,653	16,381
Dutch India					43,781	1,204
Hongkong	2,571,362	91,991	2,852,803	100,220	4,189,440	130,573
Japan	37,190	1,295	19,505	803	153,705	5,734
Siam					195,618	4,153
Turkey in Asia	57	4	215	20	240	9
Africa:						
British West Africa					33	2
Total	25,008,414	848,469	32,715,479	1,203,005	95,503,998	3,017,108
Recapitulation:						
Europe	8,924,279	276,196	7,725,425	264,246	59,508,996	1,980,161
North America	33,916	1,670	29,263	1,271	420,093	12,834
South America					542	15
Asia	16,050,219	570,603	24,960,791	937,488	35,574,334	1,024,096
Africa					33	2
Total, all rice	73,486,678	2,466,848	84,494,805	3,103,086	150,288,049	4,934,766

COUNTRIES FROM WHICH RICE IS IMPORTED.

Most of the rice imported into the United States is shipped from the continents of Asia and Europe. China and the Netherlands are heavy exporters of completely milled rice, while Japan leads in the uncleaned or "brown" rice business. Practically all rice received from China and Japan reaches the United States through the Pacific coast ports, principally San Francisco, Cal., and is mostly used to supply the demand in the Western States, where there are considerable numbers of Japanese and Chinese residents. The imports from other countries of North America were of little importance until 1914, with the exception of rough rice from Mexico, when Canadian dealers began sending in milled rice which had been imported by them in a "brown" or rough condition from Asia. The United Kingdom, with its great shipping interests, in 1913 ranked first among the European countries which export rice to the United States. During the following year, however, the Netherlands and Germany, where numerous large mills are established, furnished a major part of the rice imported from Europe. Italy and Spain, as producers and milling centers, also supply American dealers with rice in considerable quantities. The rice imported from European markets is practically all completely milled, and a large percentage

of it is coated. It enters the United States primarily through the ports of New York, Philadelphia, and Boston, from which points it is widely distributed.

DESCRIPTION OF RICE TYPES.

In the numerous samples secured for these investigations many types of rice were found. From the standpoint of total value the Japan rice was of first importance and was separated into four subdivisions, depending upon its mill finish. Other types of importance are the Chinese, Siam, Java, Bassein, and Patna, which get their names from the country or province in which they are grown. The color and luster of the rice of individual samples within each type vary considerably, and in other particulars the quality is not uniform in the types. The description of the rice types given in this bulletin, therefore, includes only those characteristics common to all samples of the type.

Rice of the Japan type has short and more or less rounded grains. Differences existing in the appearance and character of the rice, caused by varying methods of milling and by climatic influences upon the growing grain, make it necessary in commercial practice to subdivide rice of this type into four general classes. These subdivisions are (1) "brown," or the rice with only the outer hulls or chaff removed; (2) completely milled rice of a flinty texture and heavily coated with talc, calcium carbonate, or some white siliceous material resembling talc; and (3) completely milled rice of a bluish white color, semitranslucent, and very heavily coated with glucose and talc or some white siliceous mineral resembling talc. The rice of this third subdivision often has a slightly kidney-shaped grain and all samples collected of it were grown in Italy. (4) Glutinous Japan rice, completely milled. The rice of the samples belonging to this fourth subdivision which was handled in this investigation had a very soft or chalky texture and was opaque. Its shape is the same as other Japan rice described in the first and second subdivisions of this group, but it is smaller in size.

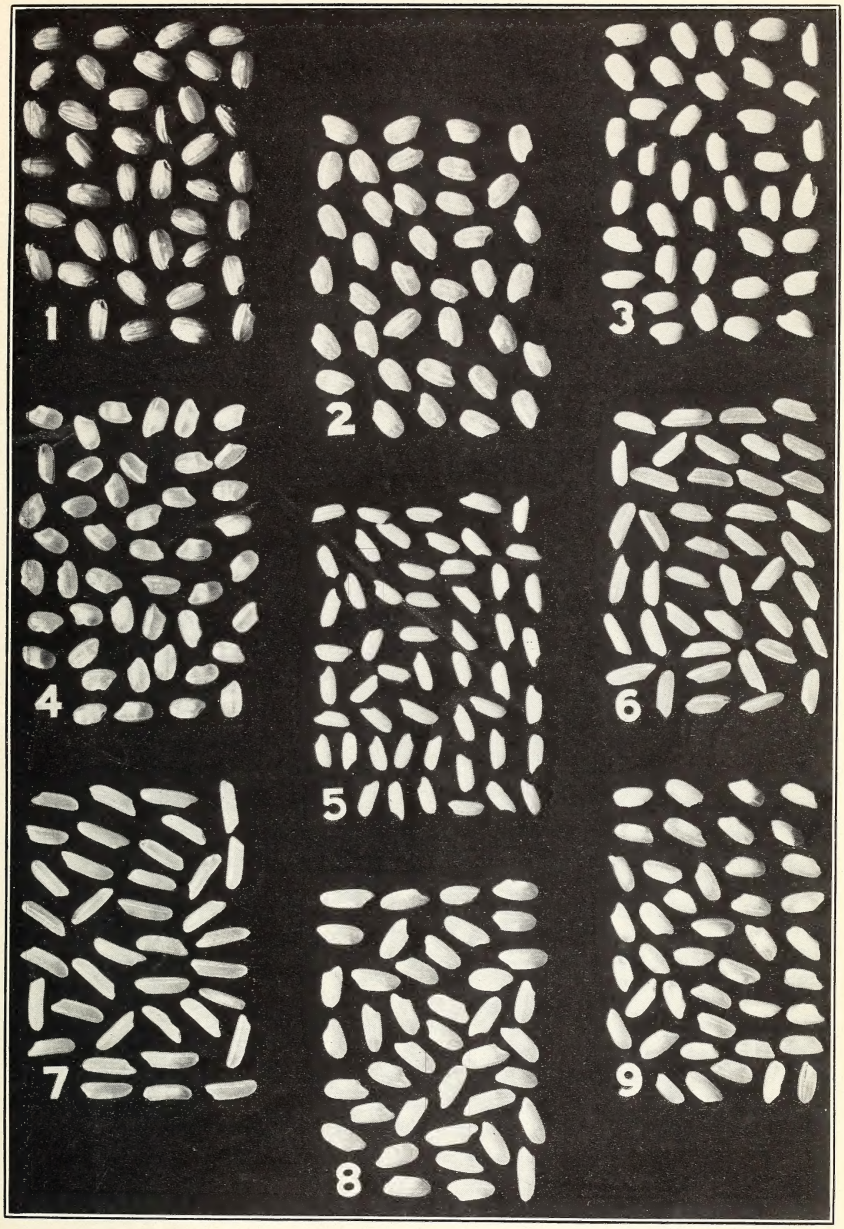
The Siam rice is generally of a flinty texture, and the grain is long and slender, with a relatively small germ.

The Chinese rice is of a white color, very flinty in texture, and of about the same shape as the Siam rice, but very much smaller.

The Java rice is of a white color and in shape is longer than the Japan rice and less rounded. Its germ is relatively large, and the grain is generally quite hard and flinty in texture.

The Bassein rice is very similar to the Java in shape, but slightly smaller in size, with a smaller germ and often a more chalky texture.

The Patna rice, which is comparatively white in color, is generally very flinty and heavily coated with glucose and talc. The kernels



WHOLE GRAINS OF THE VARIOUS TYPES OF RICE.

FIGS. 1–3.—Japan rice, grown in Japan: 1, "Brown"; 2, coated with talc; 3, glutinous. FIG. 4.—Japan rice, grown in Italy, coated with glucose and talc. FIG. 5.—Chinese rice, grown in China. FIG. 6.—Siam rice, grown in Siam. FIG. 7.—Patna rice, grown in Patna, India. FIG. 8.—Java rice, grown in Java. FIG. 9.—Bassein rice, grown in Bassein, India. (Natural size.)

are very long and very slender and have a bright luster, but otherwise they resemble the Siam rice.

A few samples of several other rice types, including "Rangoon," "Maulmein," and "Saigon," were secured. These types of rice are now of so little commercial importance in the United States that they are not described nor are the analyses of such samples tabulated in this bulletin.

Plate I shows whole grains of the various types of rice described.

MECHANICAL ANALYSES OF SAMPLES OF IMPORTED RICE.

Practically all of the samples of imported rice upon which this investigation was based were secured at the American ports of entry by officials of the Bureau of Chemistry. The samples and the information secured at the time of sampling were submitted by that bureau to the Office of Grain Standardization, where the mechanical analyses were made and the tabulating work was done.

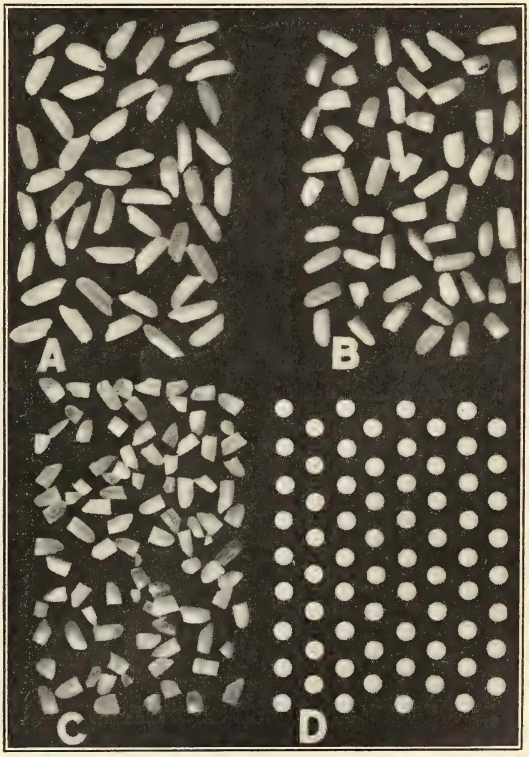


FIG. 1.—Whole and broken grains of Siam rice and a section of the screen through which they pass: A, "Whole grains;" B, "half grains;" C, broken particles which pass through a No. 6 screen with round holes six sixty-fourths of an inch in diameter, as shown in D. (Natural size.)

Only those factors which directly concern the commercial grading or affect the market value of rice were considered in the analyses, and they were determined on a 50-gram portion of each sample. In making the size separation, the weighed portion of the sample to be analyzed was first shaken on a flat metal screen with round holes six sixty-fourths of an inch in diameter. The particles which passed through the screen were weighed, and the results, calculated to a percentage basis, are recorded in Table II in the column headed "Through No. 6 screen." The whole grains and broken particles which did not pass through the screen were carefully separated by

hand picking, weighed, and the results tabulated in the columns headed "Whole grains" and "Half grains," respectively.

Figure 1 shows the results from the size separation of a sample of Siam rice, with a section of the No. 6 screen used, showing the actual size of its openings.

TABLE II.—*Summary of results of mechanical analyses of samples of rice imported into the United States.*

Number of samples, type, and quality.	Weight per 1,000 grains.	Damaged rice.	Paddy grains per 100 grams.	Size separation.			Value per hundredweight at point of shipment.
				Whole grains.	Half grains.	Through No. 6 screen.	
51 samples, Japan rice, brown:	*Grams.*	*Per cent.*	*Number.*	*Per cent.*	*Per cent.*	*Per cent.*	
Average	24.2	2.3	10.0	98.1	1.7	0.2	$3.64
Maximum	29.2	4.4	68.0	99.6	6.0	1.0	3.98
Minimum	21.2	1.1	0	93.4	.2	0	3.04
4 samples, Japan rice, glutinous:							
Average	18.7	.3	0	85.1	14.0	1.0	.....
Maximum	20.2	.6	0	94.4	20.0	1.2	.....
Minimum	17.8	.1	0	79.2	4.8	.8	.....
8 samples, Japan rice, coated with talc:							
Average	20.6	1.0	0	89.7	8.4	1.9	.....
Maximum	22.4	2.0	0	94.4	12.8	3.6	.....
Minimum	17.6	.3	0	83.6	5.2	.2	.....
10 samples, Japan rice, grown in Italy:							
Average	20.4	3.2	.8	97.5	1.5	1.0	.....
Maximum	21.0	6.0	4.0	99.6	2.8	3.0	.....
Minimum	19.8	.4	0	95.2	0	0	.....
66 samples, Chinese rice:							
Average	12.7	.4	.2	70.8	26.0	19.0	3.06
Maximum	16.8	3.5	3.0	83.0	26.0	19.0	3.69
Minimum	11.8	.1	0	57.0	26.0	19.0	2.64
44 samples, Java rice:							
Average	20.5	1.1	.01	92.1	7.2	.7	.....
Maximum	23.6	5.6	2.0	98.4	22.0	4.0	.....
Minimum	17.8	.1	0	75.6	1.4	0	.....
65 samples, Siam rice:							
Average	18.1	1.5	1.1	71.4	20.4	8.3	.....
Maximum	19.0	4.0	10.0	88.4	42.0	32.6	.....
Minimum	14.4	.4	0	40.0	10.0	0	.....
4 samples, Bassein rice:							
Average	19.0	1.7	0	93.4	5.5	1.2	.....
Maximum	20.2	1.8	0	96.6	7.0	2.6	.....
Minimum	18.6	1.6	0	91.4	2.0	0	.....
11 samples, Patna rice:							
Average	18.5	.7	.1	73.8	20.6	5.5	.....
Maximum	20.2	1.8	2.0	93.0	40.0	22.4	.....
Minimum	17.6	.2	0	56.6	6.8	0	.....

CHEMICAL ANALYSES OF SAMPLES OF IMPORTED RICE.

Chemical analyses of single samples considered characteristic of the various imported rice types were made in the Bureau of Chemistry. The determinations made on each sample covered moisture, ash, ether extract, protein, and crude fiber. The results of these analyses are given in Table III.

TABLE III.—*Results of chemical analyses of rice imported into the United States compared with the analyses of patent flour from hard spring wheat, hard winter wheat, and soft winter wheat, and with the analyses of "table grits" and unbolted meal made from white corn.*

Type and description of sample.	Moisture.	Ash.	Ether extract.	Protein.	Crude fiber.	Calculated to a moisture-free basis.			
						Ash.	Ether extract.	Protein.	Crude fiber.
Japan:	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Brown	11.52	1.22	1.92	6.75	1.10	1.38	2.17	7.63	1.24
Coated with talc or some siliceous mineral	12.21	1.31	.43	6.14	.41	1.49	.49	6.99	.47
Glutinous, uncoated	11.81	.79	.29	7.38	.37	.90	.33	8.37	.42
Grown in Italy; heavily coated	11.80	.55	.13	6.59	.36	.63	.15	7.47	.40
Chinese:									
Uncoated	12.06	.55	.20	8.06	.40	.62	.23	9.17	.46
Siam:									
Uncoated	11.81	.38	.21	7.06	.40	.43	.24	8.01	.45
Patna:									
Coated with glucose and talc or some siliceous mineral	11.97	.74	.18	8.06	.46	.84	.20	9.16	.51
Java:									
Uncoated	11.86	.40	.17	7.75	.40	.45	.19	8.79	.45
Bassein:									
Coated with glucose and talc or some siliceous mineral	12.33	.89	.25	7.19	.41	1.02	.29	8.20	.47
Hard spring wheat, patent flour [1]						.55	1.34	14.36	
Hard winter wheat, patent flour [2]						.52	1.15	11.57	
Soft winter wheat, patent flour [3]						.70	1.54	10.38	
White corn, table grits [4]						.62	1.47	9.38	
White corn, unbolted meal [4]						1.49	4.61	9.58	

[1] North Dakota Experiment Station Bulletin No. 89. 1910.
[2] Kansas Experiment Station Bulletin No. 202. 1915.
[3] Department of Agriculture, Chemical Division Bulletin No. 1. 1883.
[4] United States Department of Agriculture Bulletin No. 215. 1915.

The ash, ether extract, and crude fiber of the "brown" or partly milled Japan rice are very high as compared with the same constituents in other types of rice and other subdivisions of the Japan type. This indicates that in the ordinary method of milling rice, where practically all of the bran coat is removed, the percentage of these constituents is materially decreased.

The Japan rice marked "coated with talc," which has a very powdery surface, is shown on analysis to yield 1.49 per cent of ash. This is an exceedingly large ash content for milled rice, as shown when it is compared with that of uncoated milled rice of the same type grown in the United States, the ash content of which is only 0.51 per cent. The glutinous Japan rice, which does not seem to be milled as deeply as the other milled rices, contains a relatively large quantity of ash and also shows a relatively high percentage of protein. Of the other rice type, it is shown that as a rule the addition of a coating material increases the ash content but has little effect upon the amounts of other constituents.

In studying the protein of the various types of rice many factors seem to be of importance. Chinese white rice, which has a very small and very flinty kernel, contains in a water-free sample 9.17 per cent of protein; and Patna rice, which shows indications of severe milling, also has a high protein content. The climatic and, possibly, the soil conditions under which rice is grown seem to exert as great an influence upon the quantity of its protein as does the method or severity of milling. By comparing the protein content of the first with that of the second subdivision of the Japan rice type, as shown in Table III, it is seen that only 0.64 per cent of this constituent is scoured off in the process of milling. Even though the milling of rice does not remove the major part of its protein, as is commonly supposed, there is in the milling of a given quantity of the grain a total loss of this expensive food constituent which should be considered. Completely milled rice can not be regarded as a balanced ration, simply because a large part of the original protein remains in the starchy endosperm of the kernel after milling. In judging a food the protein content is, of course, an important factor, but it must be considered in connection with various other important factors, such as ether extract and, to a less extent, ash. As previously mentioned, the milling of rice reduces its ash content very materially, and the ether extract, the greater part of which is in the germ of the kernel, is decreased from over 2 per cent to about 0.2 or 0.3 per cent, which is almost a negligible quantity. The slight losses in protein and in minute quantities of a substance called "vitamine," together with the very great loss in ether extract and ash, which result from the modern methods of milling rice, tend to greatly lessen its food value and to yield by-products containing large quantities of valuable constituents of human food.

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